



NASA EPFD Battery Industry Day

30 November 2020

Agenda

- Lectratek Company Overview
 - Mission and Vision
 - Technology Portfolio
- Battery Technology Overview
 - Advanced Battery Cell Development
 - Domestic Battery Cell Manufacturing Capability
 - Fireproof Composites for Battery Enclosures
 - Integrated Battery Modules
- Collaboration Opportunities

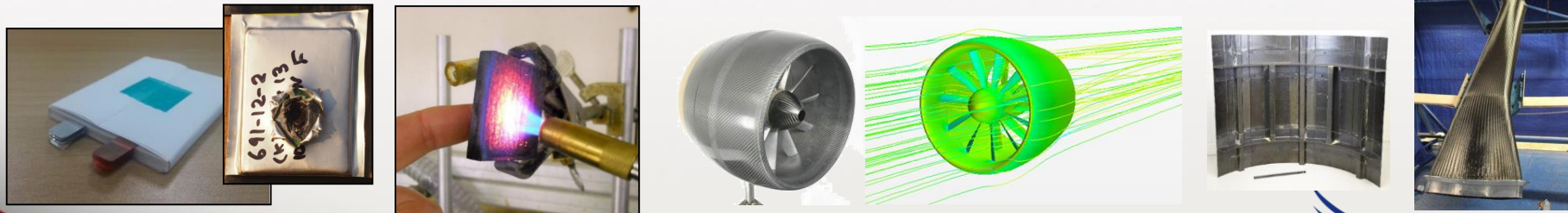
Lectratek Company Overview

- A new venture delivering propulsion and powertrain solutions to electric aircraft platform developers
- Portfolio built on on >\$25M DoD/NASA eAviation technology investment in CRG
 - CRG has 23 years R&D experience in Aerospace/Defense

Powering eAviation

Product Portfolio

- Quiet Electric Propulsors
- Safe, Integrated Battery Cells and Modules
- Lightweight, Fireproof Battery Enclosures
- Intelligent Power Distribution and Management
- Affordable, Unitized Composites Manufacturing



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Battery Tech Differentiators

- Non-flammable, low-temperature electrolyte
- In-house R&D capability for **custom cells** supported by **domestic manufacturing** capability
- Demonstrated advanced Li-ion, **Li-metal**, and Li-S cell chemistries
- Li-metal capable manufacturing equipment
- In-house pack design and system integration

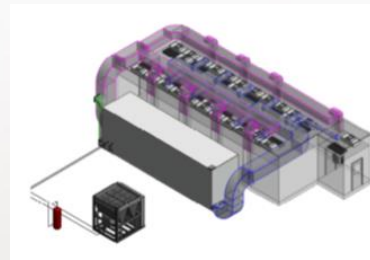
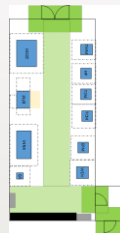
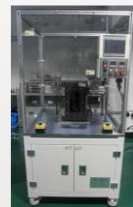
Advanced Battery Cells

- Ballistic Safe Li-ion Cell
 - Demonstrated ballistic-safe, > 200 Wh/kg at cell level, >500 cycles
- High Specific Energy Li-metal Battery
 - Demonstrated > 360 Wh/kg at cell level, non-flammable electrolyte
- Hybrid Anode Electrified Aircraft Battery (NASA)
 - Goal: > 400 Wh/kg at pack level, $>3,000$ cycles



Advanced Battery Cell Production

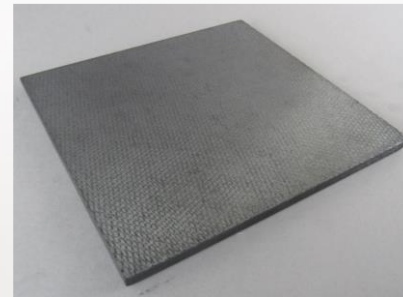
- New Facility in Dayton, OH area
 - 174,000 ft² on 60 acre campus
- Battery Cell Manufacturing
 - 1,000 ft² Dry Room
 - Semi-Automated Pilot Line
 - Li-metal capable equipment
 - 50,000 to 100,000 cells/year
 - Space for additional lines



Fireproof Composite Battery Enclosures

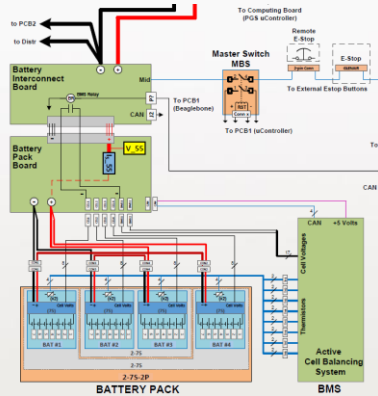
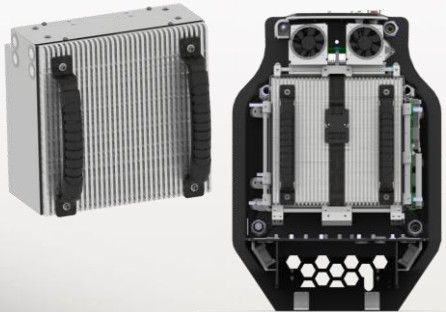
Multiple product formats leveraging CRG's unique high-temperature MG Resin:

- Syntactic Foam Insulation
 - Lightweight insulation/fire barrier
 - Demonstrated in Navy S9310 battery safety test
- High Temperature Composites
 - Fire resistant composite panels/enclosures
- High Temperature Elastomer
 - Flexible, fire resistant seals/gaskets



Intelligent Battery Modules

- Battery module design using custom or COTS cells
- Custom BMS and charge control electronics
- Cell/pack performance, environmental, and safety testing
 - In-house cell/pack testers, load banks, and environmental chambers



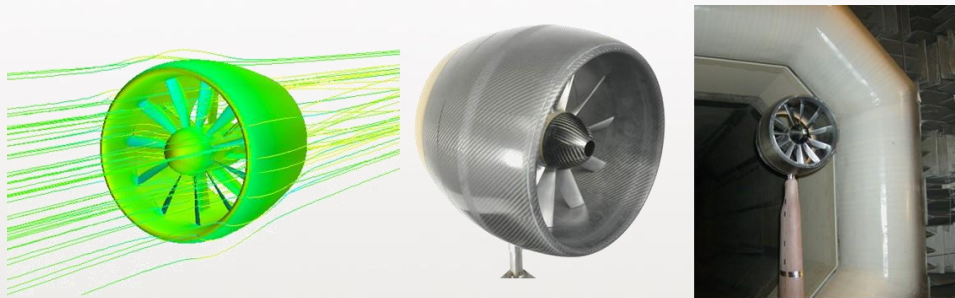
Collaboration Opportunities

- Lectratek is ready to support NASA EPFD's industry partners!
 - Custom battery cell development and prototyping
 - Domestic cell manufacturing (LRIP through full-rate)
 - Fireproof composite battery enclosures
 - Custom battery module/electronics design, build, test
 - Other enabling technologies (see Additional Information)

Additional Information

Quiet Electric Propulsors

- First CRG quiet aircraft propulsor developed for AFRL/IARPA GHO Program
- 3.5", 5", and 12" ducted fans to meet demanding acoustic, efficiency, and weight goals
- Design process is scalable (3.5" to 35" explored to date)



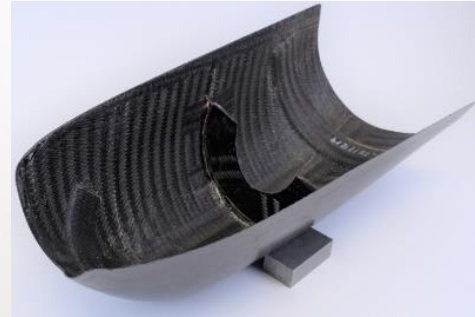
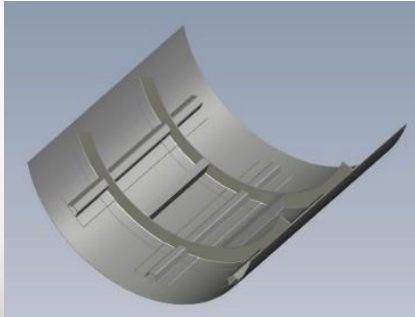
Electrical Load Management Systems

- Custom solid-state power distribution systems for aircraft (Si and SiC devices to replace electromechanical relays)
- Real-time electrical load measurement
- Enables predictive maintenance algorithms
- Automated load-shedding



Affordable, Unitized Composite Structures

- Composite infusion materials and processes to enable complex unitized structures with reduced assembly cost
- AS9100 D quality system for composite part manufacturing
- Demonstrated Air Force, DoD, NASA, DOE solutions



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Lectratek Services

- Engineering Design / Product Development
 - Electrical, Mechanical, Aerodynamics, Structural, Composites
- Custom System Development
- System Integration
- Manufacturing Process Development
- Manufacturing w/ AS9100D Quality Management System under parent company's Advanced Manufacturing Center
- Supplier Management & Extensive Partnership Network
- Sustainment & Support

Facilities

- 174,000 ft² in Dayton, OH
- Advanced Battery Cell Production
- Advanced Composite Manufacture
 - RTM, OOA, Autoclave, etc.
 - Drill & Trim Operations
- Electronics Integration

